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Original Article

Relationship between experience and training characteristics with performance in non-Olympic rowing modalities

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Abstract:
Rowing is considered one of the most complete sports in relation to physical and physiological demands, therefore training is one of its main research line. However, there is no scientific evidence of studies that relate training characteristics and experience with performance in competition. The aim of this study was to relate high and low performance rowers' experience and training characteristics of non-Olympic rowing modalities. A group of 115 male rowers from the Spanish National Championships volunteered to participate in the study. Age, experience, training days per week and training hours per day were obtained for each rower. For high performance group, inrigger is characterized by rowers who train significantly more days per week (6.93±0.26 days) and more hours per day (4.13±1.33 hours) than low performance rowers (5.96±0.87 days and 2.12±0.67 hours). On the other hand, high performance fixed seat rowers are significantly more experienced (11.65±5.11 years) than low performance rowers (7.56±7.04 years). Furthermore, they train significantly more days per week (6.43±0.66 days) than low performance fixed seat rowers (4.80±1.40 days). Therefore, this research concludes that there is a direct relationship of these variables with performance in different modalities, which highlights the usefulness of the results for coaches for the implementation of training programs and selection of rowers for best results competition.
Key words: rowing, performance, training, experience, inrigger, fixed seat.

Introduction

The sport of rowing consists in displacing a boat through the water thanks to the cyclical work strength (Gee et al., 2012) by one or more rowers, sitting with their backs to direction, using one or two oars. There are two different types of rowing modalities, fixed seat rowing, where rowers are supported on a fixed bench; and mobile seat rowing, where rowers are seated in a mobile seat that allows their movement from stern to bow, and vice versa. The time spent in 2000 m rowing race is about 6-8 minutes (Volianitis & Secher, 2009), which is one of the most important performance limitation depending of the type of boat and weather conditions, (Smith & Hopkins, 2011). Competitive rowers can get a mean power of 450-550W per stroke with a rate of 32-38 strokes per minute (Steinacker, Lormes, Lehmann, & Altenburg, 1998) during more than 200 strokes of the race.

At present, the most developed research lines in rowing are physiology, anthropometry, biomechanics and training. Regarding physiology, energy requirements are proportionated by aerobic power and anaerobic metabolic process (Mäestu, Jürimäe, & Jürimäe, 2005; Secher, 1993). Contribution of aerobic metabolism in Olympic rowing competition is about 70-80% and the remainder 20-30% comes from anaerobic glycolysis (Hagerman, Connors, Gault, Hagerman, & Polinski, 1978). Values of VO_2 are between 75-100% (Russell, Le Rossignol, & Sparrow, 1998), whereas values of VO_{2max} are between 6 (Yoshiga & Higuchi, 2003b) and 6.9 l/min (Volianitis & Secher, 2009).

Physiology variables and knowledge of the anthropometric characteristics are a good predictor of performance in rowing (Mikulić & Ruzić, 2008). The importance of the anthropometry has been stated in several studies with the aim of increasing knowledge and competitive performance (Schranz, Tomkinson, Olds, & Daniell, 2010). Height and body mass were significantly correlated with performance in rowing (Akça, 2014). The most successful rowers are taller and heavier, with a higher sitting height and with a lower fat mass than less performance rowers (Mikulic, 2009). Rowing involves almost all muscles of the body (Yoshiga & Higuchi, 2003a) but the mean feature that differentiates it from most sports is the simultaneous action of both legs during the technical execution of the stroke. Rowing biomechanics analyse technique to make it more effective by giving importance to both large and small kinetic and kinematic details (Baudouin & Hawkins, 2002). A high level of technique is essential to enable effective transfer of force through the stroke (Buckeridge, Bull, & McGregor, 2015). The aim to improve technic in rowing is to increase human propulsion engine and acceleration to boost athlete's performance. During the drive, nearly half of the required power (46%) is contributed by legs, a third by trunk (32%) and above a fifth (22%) by arms (González, 2014).

Finally, several training studies relate high level of strength with best performance in rowing (Farris, Lichtwark, Brown, & Cresswell, 2015; Gallagher, Dipietro, Visek, Bancheri, & Miller, 2010). Other studies

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emphasised the importance of the maximal strength and muscle power in rowing (Lawton, Cronin, & McGuigan, 2013; Mcgregor, Hill, & Grewa, 2004). Strength is essential for rowers and it must be worked simultaneously during training to improve aerobic endurance, a key feature in this sport (Bell, Syrotuik, Attwood, & Quinney, 1993). Gee et al. (Gee, Olsen, Berger, Golby, & Thompson, 2011) conclude in their study that all rowing coaches agreed that strength training enhanced rowing performance and 74% of coaches indicated that athletes' strength trained 2-3 times a week. To increase power in rowing, it is essential to emphasize not only strength but also anaerobic training thus decreasing the level of lactate accumulated during the practice of rowing (Randall, Jensen, & Freedson, 1996). The reviewing published research emphasize the high demands required in rowing and the need of a large volume and experience of training. Experience is an important factor in performance because it produces physical and physiological changes in the body that promote the improvement of athletes (Battista, Pivarnik, Dummer, Sauer, & Malina, 2007), besides increasing confidence in competition (Smith & Hopkins, 2012). It is important to gradually increase rowing specific training and experience to boost performance (Lehmann et al., 1992). However, there is no scientific evidence of studies whose mean objective is to relate experience and training characteristics with performance in competition. Also, scientific literature do not collect any studies about non-Olympic rowing modalities, nationally and internationally recognized, as part of this research line.

The aim of this study is to relate experience and training characteristics with performance in non-Olympic rowing modalities to find out if these variables are determinant for success in competition.

Materials and Methods

Sample

One hundred and fifteen male rowers voluntarily participated in this study, forty-one rowers with a mean age of 25.56±6.70 years old, participants in LXV Spanish Rowing Championship - Yolas (13th and 14th October 2012, Alicante) and seventy-four rowers with a mean age of 27.73±7.03 years old, participants in VIII Spanish Fixed Seat Rowing Championship - Llaüt (26th and 27th May 2012, Torrevieja). Participants gave their written consent before the start of the study, previously approved by the research ethics committee of the University of Alicante. Participants in each modality were divided into two subgroups, a group composed of high-performance rowers, who qualified to the finals and a group of underperforming with the remaining participants (J Bourgois, 2000).

Procedure and design In order to assess the study subjects' information of training characteristics, they were asked to complete a questionnaire which include name and club to classify each one in each group, years of experience in rowing, training days per week and training time in hours per day.

Statistical analysis The Statistical Package for Social Sciences (SPSS) v.22 program was used to compare the means of variables. Shapiro-Wilk statistical test was used to determine whether the quantitative variables fulfil the criterion of normality. The above variables reached the level of significance (p<0.01), fulfilling the criteria of normality, so the Student t test was used for independent variables.

Results

Table 1 shows age, experience and training characteristics of the participants in the Spanish National Championships. According to these data, rowers of high performance group of inrigger modality were younger (23.80±4.06 years old) and more experienced (11.40±3.78 years) than low performance group (26.58±7.73 years old and 9.77±5.77 years of experience). In addition, performance was significantly correlated with training days (p<0.001) and training time (p<0.001). High performance group trained 6.93±0.26 days per week and 4.13±1.33 hours per day. However, low performance group trained 5.96±0.87 days per week and 2.12±0.67 hours per day.

In fixed seat rowing modality, the age of the rowers was similar. Performance was significantly correlated with experience (p<0.001) and training days (p<0.001). High performance group have a mean rowing experience of 11.65±5.11 years and trained 6,43±0,66 days per week. Low performance group have a mean rowing experience of 7.56±7.04 years and trained a mean of 4.80±1.40 days per week. Finally, both groups in fixed seat rowing spent similar time training each day.

Table 1. Comparative analysis between high and low performance groups.

	Inrigger			Fixed Seat		
	High (n = 15)	Low (n = 23)	p	High (n = 26)	Low (n = 51)	p
Age (years)	23.80±4.06	26.58±7.73	0.445	27.35±4.32	27.90±8.01	0.847
Exp. (years)	11.40±3.78	9.77±5.77	0.183	11.65±5.11	7.56±7.04	<0.001 *
TD (d/week)	6.93±0.26	5.96±0.87	<0.001 *	6.43±0.66	4.80±1.40	<0.001 *
TT (h/d)	4.13±1.33	2.12±0.67	<0.001 *	2.33±0.56	2.09±0.45	0.092

Exp.: Experience; TD: Training days; TT: Training Time; * Significance p<0.01

Discussion

In inrigger modality, high performance rowers are younger than low performance rowers (23.80±4.06 years and 26.58±7.73 years respectively). These data are in agreement with several studies where high performance Olympic rowers are between 20 and 24 years old (Akça, 2014; Lawton, Cronin, & McGuigan, 2012; Sanada et al., 2009). Other studies about open championships depicts values nearest to low performance rowers in this research with a mean age of 26.58±7.73 years (Barrett & Manning, 2007; Greene, Sinclair, Dickson, Colloud, & Smith, 2009; Kerr et al., 2007; Slater et al., 2005, 2006).

These high performance rowers, even being younger, are more experienced than low performance rowers with an average age of 11.40±3.78 years and 9.77±5.77 years respectively. This difference is further increased in the study conducted by Mikulić (2008), where sub-elite rowers have an average experience of 8.4±3.3 years while elite-rowers reached 14.1±3.1 years. Therefore, high performance rowers are younger and have started rowing to an average of 12 years old. Low performance rowers are older and began rowing at about 17 years old, which leads us to conclude that experience is a factor to consider, though not significantly relevant.

Training volume correlated positively with performance in this research. High performance rowers train 6.93±0.26 days per week during an average of 4.13±1.33 hours, while low performance rowers train 5.96±0.87 days with sessions of 2.12±0.67 hours. These data agreed with young Olympic rowers of the research carried out by Greene et al. (2009), who trained up to 6 times per week. However, senior rowers came to perform 10 to 12 training sessions per week, like in Bourgois, Steyaert, & Boone (2014).

In this study, no age differences between high performance rowers (27.35±4.32 years) and low performance rowers (27.90±8.01 years) were found. Besides, scientific evidence was found in fixed seat rowing research, where rowers have been differentiated between high and low performance (Izquierdo-Gabarren & de Txabarri, 2010). In this study, high performance rowers were 28±5 years old and low performance rowers were 23±4 years old. However, in other studies, fixed seat modality rowers are older than fixed seat Cantabrian rowers (26±5 years). In our study rowers are 27.73±7.04 years old while in the study of Arrizabalaga, Aramendi, Samaniego, Gallego, & Emparanza (2007), the average age were 26±5 years. In the latter study, the drag factor of Concept 2 ergometer was set to simulate rowing in Trainera. These data are very similar to the study conducted by Mejuto et al. (2012), where rowers were an average age of 25.8±4.3 years old. In other studies found on fixed seat rowing, rowers were still younger (González & Ainz, 1996; González, Santiesteban, & Ainz, 1996; Lorenzo-Buceta & García-Soidán, 2015).

Experience seems to be a relevant factor in rowing success since statistically significant differences between high performance rowers (11.65±5.11 years) and low performance rowers (7.56±7.04 years) were found. Izquierdo-Gabarren & de Txabarri (2010) came up to the same conclusion, who found statistically significant differences between both groups (15.2±4.0 years and 8.3±2.0 years).

Frequency of training of two days per week can produce improvement with regards to people with poor physical fitness (Badiola, Moragón Abad, Díaz-Munío Carabaza, & Sebastia Sancho, 2008). Fixed seat rowers train an average of 5.31±1.43 days per week. Nonetheless, when observing the contrast between high and low performance in this modality, statistically significant differences were found because they train 6.43±0.66 days per week versus 4.80±1.40 days respectively. More training days per week probably will lead to achieve higher performance.

In relation to high performance rowers training volume, in the study of González (2014), rowers trained around 12 hours per week. These data are consistent with high performance rowers of this study who train an average of 2.33±0.56 hours per day, which also accounts for about 12 hours a week taking into account the average training days per week. Rowers in the study of Arrizabalaga et al. (2007) trained 14 hours per week. However, there are little differences between training hours per day in each group, indicating that training more hours a day is not a guarantee of being more successful in competition.

Conclusions

This study has presented scientific proof of the impact that training load has in performance in competitions, both for inrigger and fixed seat rowing modalities. First, in inrigger rowing modality, high performance rowers are younger, but more experienced, than low performance rowers. Regarding training characteristics, high performance rowers train significantly more days per week and more hours per day than low performance rowers.

Second, high performance fixed seat rowers are significantly more experienced than low performance rowers. Regarding training characteristics, high performance rowers train significantly more days per week but not more hours per day.

These results are useful for coaches of both rowing modalities in the set up of the training program and selection of candidate rowers to obtain the best teams for competitions.

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